



## Newsletter

The IES Newsletter is published bimonthly by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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*Enveloped by fog, a researcher crouches to collect a cloud water sample from a passive collector atop Mt. Washington, N.H.*

## Acid Rain Research at the Institute

*by Marc Breslav*

One catches clouds on mountaintops across the country. Another collects rain from remote sites around the world. These are the two newest, and perhaps most exciting, projects related to acid rain which are conducted under the auspices of the Institute of Ecosystem Studies. But though these two projects and the Institute itself are relatively new, other acid rain research has been ongoing for 20 years, brought to the Institute by its Director, Gene E. Likens.

Dr. Likens is perhaps best known for his joint leadership of the Hubbard Brook Ecosystem Study, a long-standing and intensive study of forested watersheds in New Hampshire's White Mountains, done in cooperation with the U.S. Forest Service. Because of the volume of research conducted at Hubbard Brook by dozens of scientists over two decades, it may well be the most intensively studied tract of land anywhere. It was at Hubbard Brook in 1963 that Dr. Likens and others first discovered the phenomenon of acid rain in North America. In looking at the way nutrients flowed through watersheds, they were examining the incoming chemical content of precipitation, as well as the outgoing chemical content of streams.

More than 20 years later, precipitation chemistry, including pH measurement, continues to be recorded, funded by the National Science Foundation. In a sense, it is a national "treasure," as it is the longest continuous record of acid deposition in North America. It is only with such long-term data that acid rain trends can be observed.

While acid rain occurs only when there is rain, acidic cloud water, or "acid fog,"

can bathe upper elevation forests for days at a time. Dr. Likens and F. Herbert Bormann of the Yale University School of Forestry and Environmental Studies are the principal investigators of the "1984 Cloud Water Project," funded by the Andrew W. Mellon Foundation. The project is the first nationwide study of cloud water chemistry. The data collected may provide baseline information on the location, severity and possible effects of acid cloud water.

An ingenious cloud water collector has been specially developed for the project by Bruce Daube and colleagues at the Worcester Polytechnic Institute and the Appalachian Mountain Club. Looking much like a box-like plastic jet engine, the collector has a battery-powered fan on one end which draws in air, and any accompanying cloud water, through an opening on the bottom. The air passes through a wall of nylon strands at about 32 kph. (20 mph.). Moisture impacts on the strands and drips into a container. Samples are taken from the container periodically by a site operator for later laboratory analysis. The active design involving a fan allows collection when there is no wind to drive the cloud water into the collector.

Collectors are located at some ten mountain and coastal sites across the country. The locations, which read like an itinerary to the most scenic fogbound destinations in North America, include Redwood National Park in California; Mount Washington, N.H.; the Blue Ridge Mountains of Virginia; and Pico del Oeste in Puerto Rico. Mohonk Mountain, near New Paltz, N.Y., is the closest site locally. The entire

*Continued on page 2*



## ACID RAIN RESEARCH . . .

(continued from page 1)

project is being coordinated from the Institute by Research Assistant Kathleen C. Weathers, who, coincidentally, was born with the name.

Another relatively new project, recently funded by the National Oceanographic and Atmospheric Administration (NOAA), involves a further-flung network of sites in remote areas of the world. The "Global Trends Network" consists of stations in locations like Amsterdam Island in the middle of Indian Ocean; Katherine, Australia; the southern tip of South America; and Cape Point near the tip of the African continent. In fact, the project is even collecting precipitation from aboard ships crossing the Atlantic and Pacific Oceans. Precipitation is collected by event, that is, each time it rains, its chemistry is analyzed.

In conducting the project, Dr. Likens and James N. Galloway of the University of Virginia are attempting to learn more about the acidity of precipitation prior to the Industrial Revolution. Some of the sites exhibit what may have been the pristine condition of precipitation before the advent of coal-fired power plants and other contributors to acid rain in the Northern Hemisphere. Theoretically, by understanding such background levels, scientists can better gauge how much of the acids in precipitation are naturally occurring, and how much are a result of human activity. The acidity of rain in eastern North America is much greater than in those remote sites. Most significantly, the amount of sulfate in the rain of the East is some 15 to 20 times greater than that in the distant sites.

Dr. Likens also contributes data to another precipitation-monitoring network, this one closer to home. He has recently been funded by the U.S. Department of Energy, through NOAA, to continue to run a station in Ithaca, N.Y., one of nine "MAP3S" stations in the eastern United States. (See article on Thomas J. Butler elsewhere in this issue.) The "MAP3S" network was originally established to provide the data needed for modeling how sulfur pollutants from power plants are transported over long distances. In fact, "MAP3S" is the acronym for "Multi-State Atmospheric Power Production Pollution Study." While the modeling aspect of the project is now over, the network still provides the highest quality data of any precipitation chemistry-monitoring network in the country, allowing continued analysis of regional acid rain trends.

Right on the Arboretum, the Institute has set up a Class A weather station, where the chemistry of rain is being measured and reported in the local media. Data from this weather station and other planned research will help Institute scientists to understand acid rain trends and effects right at home in the mid-Hudson valley.

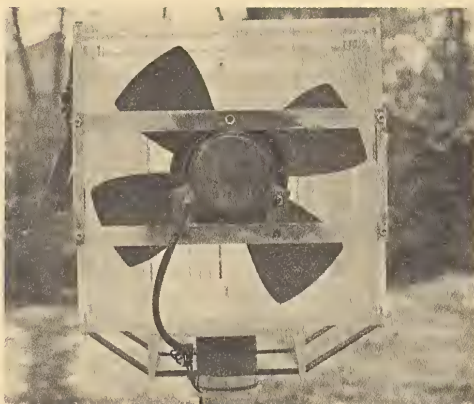
The Andrew W. Mellon funds which Dr. Likens has used for the Cloud Water Project have also permitted him to seed creative research by graduate students who worked with him at Cornell University. Frank Ver-

## Institute Scientists Visit Ocean Bottom



Susumu Honjo

Working with Susumu Honjo (not pictured), a geologist at the Woods Hole Oceanographic Institute, Jonathan Cole (right), Institute Aquatic Microbiologist, and Nina Caraco, a Hubbard Brook collaborator and graduate student at Boston University, participated in a research cruise on the RV Atlantis II, 300 kilometers south of the Pacific coast of Panama. The research cruise made use of the submersible ALVIN, a small 3-person submarine equipped with mechanical arms and photographic gear. Dr. Cole and Ms. Caraco dove several times to 4,000 meters (more than two miles) to place experiments on the sea floor. The purpose of the project, which is funded by the National Science Foundation's Chemical Oceanography branch, is to investigate the decomposition of surface materials when these materials sink to the sea floor. By studying this process, scientists can learn more about the environment of the ocean bottom, and how bottom life derives its nutrients.



Kathleen C. Weathers

Looking much like a box-like plastic jet engine, an active collector has a battery-powered fan on one end which draws air, and any accompanying cloud water, through a wall of nylon strands (visible behind fan).

tucci is one of these students, who originally set out to use Landsat satellite images to determine the pH of lakes. His preliminary findings have indicated certain problems with use of these images, and he now has shifted his focus primarily toward the use of laser fluorosensing. Essentially, a laser beam is bounced off a lake from an airplane, and depending on the wavelengths of light returned, versus those that were absorbed, researchers may be able to determine the lake's pH.

The ultimate result is that by using such remote sensing techniques, scientists may be able to identify acidified lakes in inaccessible areas, and are able to sample large numbers of lakes in a minimum of time. Researchers can also use the techniques to study lakes in countries they are generally barred from, such as the Soviet Union. Yet, information on the acidity of these lakes is crucial to understanding the global distribution and consequences of acid rain.



# Major Campaign to Create Perennial Garden Begun

by Marc Breslav

The Institute of Ecosystem Studies has begun a campaign to raise \$200,000 toward the construction of a world-class Perennial Garden adjacent to its Gifford House Visitor and Education Center.

The campaign was announced in early May by a committee of more than a dozen local citizens who are spearheading the fund-raising effort. The committee is chaired by Oakleigh Thorne of Millbrook.

Over \$150,000 has already been pledged by interested individuals and foundations.

"This exceptional Perennial Garden will be equal to any found elsewhere in the world," said Institute Director Gene E. Likens. "It will simultaneously be an outstanding display garden as well as an innovative teaching tool for ecological and horticultural programs here."

Planned to be the Institute's primary horticultural display, the garden promises to be a major Hudson Valley attraction. When complete, it will be one of the largest collections of perennials in this country, and a garden of worldwide significance.

It is expected that the first major section of the display will open in June, 1985, and that the project will be completed the following year.

A major emphasis of the garden will be on low maintenance perennials — those that require comparatively little work from the home gardener once the garden is completed.

The display will consist of a series of demonstration beds surrounding a large octagonal sunken garden. The demonstration beds will show how various perennials can be used such as for ground cover, for

planting in shady areas, or for special effects at various seasons.

The Perennial Garden will also contain the newest and best varieties of plants from breeders around the world, a number of whom have already contributed plants. Plants from some of the Arboretum scientists' past expeditions to the Soviet Union and China, among other places, will be evident.

Collections of such important perennial groups as peonies, irises, day lilies and ornamental grasses will also be featured.

The garden has been designed by Institute Horticulturist Robert S. Hebb, a nationally-recognized authority on perennials and perennial gardens. Mr. Hebb is the author of *Low Maintenance Perennials* and is presently writing a major reference work on perennials to be published next year.

## New Faces by Marc Breslav

### Donald C. Buso

*Research Assistant*



Cindy Buso

A native of Hyde Park, N.Y., Donald C. Buso has since 1975 worn the many hats of a field technician at the Hubbard Brook Experimental Forest in New Hampshire.

Mr. Buso collects samples of the weekly precipitation, stream and lake water that Institute Director Gene E. Likens has been measuring for the past 20 years at Hubbard Brook.

Mr. Buso measures pH and conductance of the various samples he collects, and then sends them on to Neal Scott, Laboratory Technician at the Institute, for the more sophisticated analysis that the laboratories in Millbrook can handle. The

data that Mr. Buso carefully and conscientiously collects eventually are published by Dr. Likens and others. Some of the published work has even ended up on the desk of William Ruckelshaus, Administrator of the U.S. Environmental Protection Agency.

### Thomas J. Butler

*Research Support Specialist*



Stephanie Behler

Thomas J. Butler helps run a precipitation chemistry monitoring station near Ithaca, N.Y. Mr. Butler works under a National Oceanographic and Atmospheric Administration grant

held by Dr. Likens to operate the station.

Mr. Butler collects samples on an event basis, or each time it rains or snows. The station is part of a high-quality monitoring network known as MAP3S, set up several years ago to understand better the deposition of sulfur pollutants across the country. Mr. Butler has helped with the installation of similar monitoring stations around the world. He analyzes trends and historical aspects of precipitation chemistry for Dr. Likens, and hopes to look at the relationship of acid-neutralizing agents and their effects on precipitation acidity.

Mr. Butler received his B.S. from Cornell in 1973, and an M.S. from Louisiana State University in 1975. He has also served as a research support specialist at Cornell's Ecosystems Research Center, where he studied nutrient cycling in North American grassland ecosystems.

## Joint Program with Yale Set

by Marc Breslav

The Institute of Ecosystem Studies and Yale University have formed a Joint Program in Ecological Studies (JPES) whose interdisciplinary approach and combined resources promise to provide doctoral candidates at Yale with an excellent opportunity for training and research in ecology. All students in the program will receive full tuition and stipend for three years. Up to five graduate students will be supported as Cary Fellows by Institute funds. Lars Hedin, a first-year graduate student from Sweden, has been selected as the first Cary Fellow.

The JPES will encourage participation in Institute research by Cary Fellows and other Yale doctoral students, and will also bring them to Millbrook for a variety of classroom and field experiences. In addition to being fully funded, they will have all the benefits that any Yale student would, as well

as the opportunity for involvement with the Institute's research and staff. The Institute also will provide them with facilities for laboratory and field work, and dormitory space permitting long- or short-term research projects in residency.

Students interested in applying to the JPES should contact:

Director of Graduate Studies  
Department of Biology  
PO Box 6666  
Yale University  
New Haven, CT 06511

Institute Director Gene E. Likens is Pro-

# Inside the Institute

by John Bakke

## Likens Wins Award

Gene E. Likens, Director, has won an award from the Citizens' Conference to Stop Acid Rain. Presented at the conference sponsored by the New Hampshire Citizens' Task Force on Acid Rain and Friends of the Earth, the Acid Rain '84 Citizens' Award recognized Dr. Likens' work with the Hubbard Brook Experimental Forest and its "outstanding contributions toward solving the acid rain problem."

## Symposium Held Here

Earlier this year, the Eighth Eastern Pine and Meadow Vole Symposium was held in Millbrook for the first time ever, at the Institute. Researchers from nearly all the eastern land grant schools attended the event, a forum for studies of voles — a genus of small rodents that is known to damage crops. Representatives from regulatory agencies and related industries also attended. Institute Wildlife Ecologist, Jay B McAninch, hosted the event.

## Guide Wins Award

A field guide written by Thomas S. Elias, former Dendrologist and Assistant Director, and Coordinator of Education, Peter A. Dykeman, has been recognized by *Library Journal* magazine as being one of the 100 best scientific books published in 1983. *Field Guide to North American Edible Wild Plants* is the third book to win the magazine's award for Dr. Elias, whose books *Extinction is Forever* and *The Complete Trees of North America* had previously made the magazine's top 100.

## Federation Fellowship Funds Student

The National Wildlife Federation has awarded Nina Caraco an environmental conservation fellowship to do limnological research at Hubbard Brook in cooperation with Institute scientists. Ms. Caraco, a PhD candidate at Boston University's Marine Program in Woods Hole, Ma., will work with Institute Director Gene E. Likens and Aquatic Microbiologist Jonathan J. Cole on the problem of where acid inputs go once they enter the lake ecosystem, and what effects they have on this system.



Marc Breslav

*Gene E. Likens, Institute Director, left, and Millbrook Mayor Michael P. Murphy greet each other in front of the village library, where one of the donated trees was planted.*

## Trees Donated To Millbrook

Approximately 25 young trees donated by the Institute were planted in the Village of Millbrook in late April with the assistance of the village's Beautification Committee. The trees — once part of an experiment on the effects of ambient air pollution — were donated to the village as an extension of Mary Flagler Cary's interest in Millbrook, according to Institute Director Gene Likens. "It seemed a fitting gesture for us to continue Mrs. Cary's interest in the village," he said.

## Library Receives Donations

The creation of the Institute has resulted in the donation of several valuable collections of ecologically-related reprints and periodicals to the Institute's library. Dr. John F. Reed, father of NYBG vice-president John F. Reed, made a generous donation of over 4,000 scientific reprints spanning a very critical period in the development of the field of plant ecology. Dr. Reed also contributed a number of sets of periodicals. George M. Woodwell, Director of The Ecosystem Center of the Marine Biological Laboratory at Woods Hole, Ma., donated several valuable sets of scientific journals. Miss Francoise Kelz of Sharon, Ct. also donated several sets of journals, including issues of *Science*. Finally, journals from the Lamont C. Cole collection of Section of Ecology and Systematics at Cornell University, spanning more than 20 years, were acquired. Readers interested in donating materials to the Institute's library to continue the expansion begun by these recent additions should contact Betsy Calvin, Librarian, at (914) 677-5343.

## Summer Calendar

Courses, Sunday Special Programs and other formal public programs are not offered during July and August. However, the Gifford House Visitor and Education Center and the Arboretum remain open for visitors. Formal public programs will resume in September. For more information, contact (914) 677-5359.

## The New York Botanical Garden Institute of Ecosystem Studies

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